

# PATENT COOPERATION TREATY

PCT

## NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Commissioner  
US Department of Commerce  
United States Patent and Trademark  
Office, PCT  
2011 South Clark Place Room 524  
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in its capacity as elected Office

Date of mailing (day/month/year) 26 October 2000 (26.10.00)	
International application No. PCT/SE00/00411	Applicant's or agent's file reference Case 43756
International filing date (day/month/year) 02 March 2000 (02.03.00)	Priority date (day/month/year) 10 March 1999 (10.03.99)
Applicant FORSLUND, Kjell et al	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:  
03 October 2000 (03.10.00)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was  
☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer R. E. Stoffel Telephone No.: (41-22) 338.83.38
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## PATENT COOPERATION TREATY

## PCT

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

REC'D 24 APR 2001

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14

Applicant's or agent's file reference Case 43756	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/SE00/00411	International filing date ( <i>day/month/year</i> ) 02.03.2000	Priority date ( <i>day/month/year</i> ) 10.03.1999
International Patent Classification (IPC) or national classification and IPC D 21 D 5/06		
Applicant Valmet Fibertech Aktiebolag et al		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 3 sheets, including this cover sheet.

☒ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 3 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 03.10.2000	Date of completion of this report 27.03.2001
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. 08-667 72 88	Authorized officer Jan Carlerud/ELY Telephone No. 08-782 25 00

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/SE00/00411

## I. Basis of the report

### 1. With regard to the **elements** of the international application:\*

- ☐ the international application as originally filed
- ☒ the description:  
 pages 1, 3-7 , as originally filed  
 pages 2 , filed with the demand  
 pages \_\_\_\_\_ , filed with the letter of \_\_\_\_\_
- ☒ the claims:  
 pages \_\_\_\_\_ , as originally filed  
 pages \_\_\_\_\_ , as amended (together with any statement) under article 19  
 pages 8-9 , filed with the demand  
 pages \_\_\_\_\_ , filed with the letter of \_\_\_\_\_
- ☒ the drawings:  
 pages 1-2 , as originally filed  
 pages \_\_\_\_\_ , filed with the demand  
 pages \_\_\_\_\_ , filed with the letter of \_\_\_\_\_
- ☐ the sequence listing part of the description:  
 pages \_\_\_\_\_ , as originally filed  
 pages \_\_\_\_\_ , filed with the demand  
 pages \_\_\_\_\_ , filed with the letter of \_\_\_\_\_

### 2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language \_\_\_\_\_ which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

### 3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

### 4. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages \_\_\_\_\_
- ☐ the claims, Nos. \_\_\_\_\_
- ☐ the drawings, sheet/fig \_\_\_\_\_

### 5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2 (c)).\*\*

\* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

\*\* Any replacement sheet containing such amendments must be referred to under item I and annexed to this report.

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/SE00/00411

## V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

### 1. Statement

Novelty (N)	Claims	<u>1-9</u>	YES
	Claims		NO
Inventive step (IS)	Claims	<u>1-9</u>	YES
	Claims		NO
Industrial applicability (IA)	Claims	<u>1-9</u>	YES
	Claims		NO

### 2. Citations and explanations (Rule 70.7)

This Report refers to the amended claims filed 03-10-2000.

Documents cited in the International Search Report:

- A) US 4529509 A
- B) EP 485153 A1
- C) EP 275967 A2

The invention relates to a screening apparatus for separating fibre suspensions. It is intended to reduce the problems with thickening of the suspension close to the reject outlet.

According to the invention, the apparatus comprises a screening housing with a centrally located stator enclosed by a rotating screening means. On the stator at least one barrier- and pulse element is arranged, extending in axial direction along the entire stator and from the stator out to the screening means so that accept is prevented from tangentially passing the barrier- and pulse element. On rotation of the screening means, the element creates pulses to the fibre suspension.

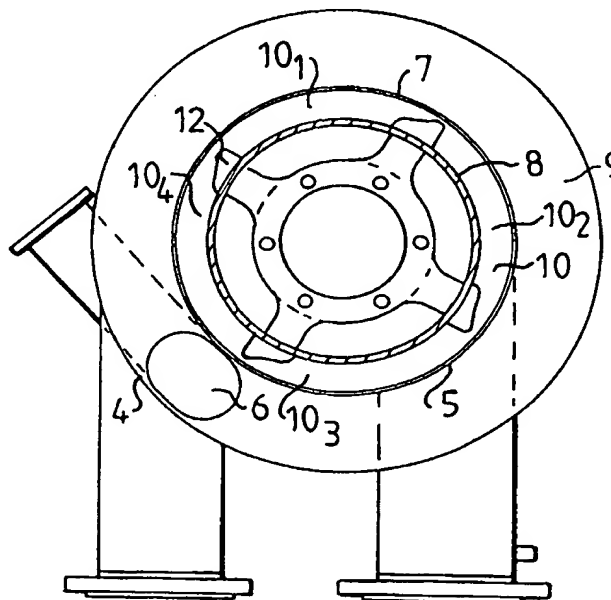
Document A, which is considered most relevant to the invention, discloses a screening apparatus with a rotating screen. Inside the screen a number of baffle plates are arranged. Accept can pass tangentially inside the plates. According to the invention, the barrier elements are tight to the central stator so that suspension cannot pass. Therefore, the invention specified in claims 1 and 9 is novel.

Documents B-C are cited as further examples of state of the art technique.

In view of what is disclosed in the cited documents, the invention is considered to involve an inventive step. It is also industrially applicable.

## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<b>(51) International Patent Classification <sup>7</sup> :</b> <b>D21D 5/06</b>	<b>A1</b>	<b>(11) International Publication Number:</b> <b>WO 00/53845</b> <b>(43) International Publication Date:</b> 14 September 2000 (14.09.00)
<b>(21) International Application Number:</b> PCT/SE00/00411 <b>(22) International Filing Date:</b> 2 March 2000 (02.03.00) <b>(30) Priority Data:</b> 9900869-0 10 March 1999 (10.03.99) SE <b>(71) Applicant (for all designated States except US):</b> VALMET FIBERTECH AB [SE/SE]; S-851 94 Sundsvall (SE). <b>(72) Inventors; and</b> <b>(75) Inventors/Applicants (for US only):</b> FORSLUND, Kjell [SE/SE]; Bruksgårdsvägen 4, S-863 31 Sundsbruk (SE). KRISTRÖM, Klas [SE/SE]; Stänkvägen 13, S-860 30 Sörberge (SE). WIKSTRÖM, Tomas [SE/SE]; Lysekilsvägen 45, S-857 33 Sundsvall (SE). <b>(74) Agent:</b> SUNDQVIST, Hans; Valmet Fibertech AB, S-851 94 Sundsvall (SE).		<b>(81) Designated States:</b> AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).  <b>Published</b> <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>
<b>(54) Title:</b> SCREENING APPARATUS		
<b>(57) Abstract</b> <p>A screening apparatus for separating fiber suspensions, preferably pulp suspensions, comprising a screen housing (1), centrally located in the screen housing (1), a stator (8) enclosed in a screen means (7). The screen means is rotary and divides the screen housing (1) into a screen chamber (9) between the screen housing (1) and screen means (7) and an accept chamber (10) between the screen means (7) and stator (8). On the stator (8), wings are located for creating suction pulses. The screening apparatus comprises further inlet (4) for the fiber suspension to the screen chamber (9), reject outlet (6) for reject from the screen chamber (9), and accept outlet (5) for accept from the accept chamber (10). In such a screening apparatus, problems arise by thickening and plugging. The invention solves these problems in that on the stator (8) at least one barrier/pulse element (12) is located which extends in axial direction along the entire stator (8) and is tightly attached to the stator (8) and extends from the stator (8) out to the screen means (7), so that accept substantially is prevented from tangentially passing the barrier/pulse element (12).</p>		



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### Screening apparatus

This invention relates to a screening apparatus for separating fiber suspensions, preferably pulp suspensions. The screening apparatus comprises a screen housing and centrally enclosed therein a stator, which is surrounded by a screen means co-axial with the stator and rotary about a rotor shaft. The screen means divides the interior of the screen housing into a screen chamber between the screen housing and screen means and an accept chamber between the screen means and stator. The screening apparatus further comprises an inlet for the pulp suspension to the screen chamber, a reject outlet for reject from the screen chamber and an accept outlet for accept from the accept chamber.

Such screening apparatus is used at the coarse and fine screening of pulp suspensions, preferably for fractionating or separating impurities and other impurities not desired to be included in the final product, such as shives, coarse particles, scrap, stones or undigested or not refined chip bits. The screening apparatus then usually is pressurized.

The pulp suspension to be screened is introduced via the inlet to the screen chamber where the approved fraction, the accept, flows through the rotating screen means. The accept is thereafter discharged through the accept outlet. In order to create suction pulses, pulse elements are provided on the stator. The pulse elements are designed as wings extending in axial direction along the entire stator and screen means. The wings are arranged in such a manner, that the pulp suspension can pass between the wings and stator.

The portion of the pulp suspension which does not pass through the screen means (the reject), is discharged via a reject outlet, which usually is located as a radial outlet at the lower portion of the screen housing.

A well-known problem in this connection, for example at the screening of papermaking pulp, is that the pulp suspension in the screen chamber, relatively close to the reject outlet, assumes a pulp concentration higher than that of the pulp suspension relatively

close to the inlet. This is due to the fact that at screening the liquid in the pulp suspension is transported to and through the screen means at a higher speed than the fibers in the pulp suspension. Thus, a dewatering of the pulp suspension is obtained, which results in that the suspension increasingly is thickened the closer at the reject outlet it arrives. Thereby a thickened reject layer is obtained at the screen means near the reject outlet. The thickening increases still more at a relatively low flow in the reject outlet, i.e. at low reject discharge. At heavy thickening a problem arises, viz. the moment transfer between screen housing and screen means at the thickened pulp suspension. This has a braking effect on the screen means, which causes increased energy consumption for rotating the screen means and may even result in stopping the screen means. The thickening can also cause plugging and, thereby, problems with removing the reject via the reject outlet. Today, it is desired to be able to screen pulp suspensions with as high a pulp concentration as possible. The thickening, thus, becomes a great problem, because the pulp suspension already at its introduction to the screen chamber has a high concentration.

The present invention has the object to show an apparatus, which to a great extent reduces or eliminates the stated problems with thickening.

This object is achieved by a screen apparatus of the kind described in the introductory portion, which comprises at least one barrier/pulse element. The barrier/pulse element is located on the stator and extends in axial direction substantially along the entire stator and entire screen means and is capable upon rotation of the screen means to create in addition to suction pulses also pressure pulses to the pulp suspension in the screen chamber. The pressure pulses produce a substantially radially directed pump effect to the screen means and outward in the pulp suspension in the screen chamber, so that the reject continuously and already directly after the start of the screen passes through the reject outlet. Consequently substantially no thickened reject layer is built up, and the risk of plugging is reduced considerably. It is, thus, possible to screen at higher pulp concentrations without disturbances.



The barrier/pulse element, contrary to the pulse elements of prior art, is attached tightly to the stator and extends from the stator outward to the screen means, so that the accept substantially is prevented from tangentially passing the barrier/pulse element. The accept is thereby forced either to move axially to the accept outlet or due to the pressure pulse radially to the screen means, whereby the screen means is cleaned, and the pulp suspension in the screen chamber is mixed with that accept portion, which passes out through the screen means.

In addition to the aforementioned advantages, such a screen has proved to yield a uniform quality of the accept even when the inject has a non-uniform quality with regard to the content of, for example, shives, coarse particles, knots, incompletely digested or unrefined chip bits.

The characterizing features of the invention are apparent from the attached claims.

The invention is described in greater detail in the following, with reference to the accompanying drawings illustrating an embodiment of the invention.

Fig. 1 shows a screening apparatus according to the invention,

Fig. 2 is a radial section of the screening apparatus according to the invention,

Fig. 3 shows an enlargement of the barrier/pulse element in Fig. 2,

Fig. 4 shows another design of the barrier/pulse element in Fig. 3,

Figs. 5 and 6 show other embodiments of the barrier/pulse element.

The screening apparatus in Fig. 1 comprises a pressurized screen housing 1 with an upper portion 2, which has a greater diameter than the lower portion 3 of the screen housing. In the upper portion 2 of the screen housing 1 a substantially tangential inlet 4 is located for the fiber suspension to be separated, which in this example is a pulp

suspension. An accept outlet 5 for the accept is located substantially tangentially in the lower portion 3 of the screen housing 1. A reject outlet 6 is located substantially axially and downward directed in the lower side of the upper portion 2, but radially seen outside the lower portion 3.

In the upper portion 2 of the screen housing a rotation symmetric screen means 7 is located so that it is rotary about a vertical rotor shaft 11. A stator 8 is located radially seen inside the screen means 7. The screen means 7 and stator 8 are arranged co-axially. The screen means 7 defines the upper portion 2 of the screen housing 1 in a screen chamber 9 between the screen housing 1 and screen means 7 and an accept chamber 10 between the screen means 7 and stator 8.

The screen means 7 can be of any type of screen means comprising screen apertures of a suitable size for passing through the desired portion of the pulp suspension. The screen means, for example, can have slits with openings between 0.1 mm and 0.5 mm, or holes with hole diameters between 0.1 mm and 12 mm, and at coarse screening preferably 8–10 mm.

In the lower portion 3 of the screen housing a lower accept chamber 13 is located which constitutes an extension of the accept chamber 10.

On the stator 8 four barrier/pulse elements 12 are located symmetrically. The barrier/pulse elements 12 can be one or more in number, but suitably 2–8 and most suitably 3–4, and advantageously arranged symmetrically in the circumferential direction of the stator 8.

The barrier/pulse elements 12 extend in axial direction along the entire stator and are attached tightly to the stator 8. They extend from the stator 8 and out to and along the entire screen means 7. The distance between the barrier/pulse elements 12 and screen means 7 shall be so short that the accept substantially does not pass therebetween. A suitable minimum distance between the barrier/pulse element 12 and screen means 7 is 4 to 10 mm. The accept chamber 10 is thereby divided into a number of smaller

accept cells 10<sub>1</sub>, 10<sub>2</sub>, 10<sub>3</sub> and 10<sub>4</sub>, each of which communicates with the lower accept chamber 13 in the lower portion 3 of the screen housing and thereby with the accept outlet 5.

At the embodiment shown, the barrier/pulse elements 12 extend in axial direction straight downward from above. In order to assist in feeding the accept in the accept cells 10<sub>1</sub>, 10<sub>2</sub>, 10<sub>3</sub> and 10<sub>4</sub> to the accept outlet 5, the barrier/pulse elements 12 can instead be designed so that they axially seen in the direction to the accept outlet 5 (in this example downward from above) deflect in the rotation direction of the screen means. Hereby the accept is guided more easily to the accept outlet 5, and a lower pressure drop above the stator 8 is obtained.

The pulp suspension to be separated is fed via the inlet 4 into the screen chamber 9. The rotating screen means 7 transfers mechanically energy to the pulp suspension in the screen chamber 9, which thereby follows the rotation direction of the screen means at the same time as it moves downward and thereby in a screwing movement moves down through the screen chamber 7. When the screen means rotates, a suction pulse arises on the rear side of the barrier/pulse element 12, seen in the rotation direction. The accepted fraction of the pulp suspension flows thereby through the rotating screen means 7 and into one of the accept cells 10<sub>1</sub>, 10<sub>2</sub>, 10<sub>3</sub> or 10<sub>4</sub>. The main portion of the accept flows thereafter down to the lower accept chamber 13 and out through the accept outlet 5.

During the rotation of the screen means 7, the accept in the accept cells 10<sub>1</sub>, 10<sub>2</sub>, 10<sub>3</sub> and 10<sub>4</sub> partially follows along in the rotation of the screen means 7. When the accept approaches the barrier/pulse element 12, portions of the accept are pressed back out through the screen means 7 and out into the screen chamber 9. Thereby the screen means 7 is cleaned of possible cloggings, and the pulp suspension in the screen chamber 9 is mixed with the accept fraction from the accept chamber 10. Hereby too heavy a thickening of the pulp suspension in the screen chamber 9 is prevented, and at the same time also a rotation of the accept in the same direction in the accept chamber 10 is prevented.

The portion of the pulp suspension in the screen chamber 9 which cannot pass through the screen means 7, continues to move in a screwing movement down through the screen chamber 9 and out through the reject outlet 6.

The barrier/pulse element 12, in order upon rotation of the screen means 7 to produce strong pressure pulses to the pulp suspension in the screen chamber 9, suitably is designed as shown in Fig. 3. Facing toward the screen means 7, the barrier/pulse element 12 has a pulse surface 14, where the distance between the pulse surface 14 and screen means 7 decreases in the rotation direction of the screen means to the point where the barrier/pulse element 12 is located closest to the screen means 7. When the accept approaches the barrier/pulse element 12, it is thereby forced by the shape of the barrier/pulse element 12 out through the screen means 7 and out into the screen chamber 9.

In Fig. 4 the same design of the barrier/pulse element as in Fig. 3 is shown, but here the barrier/pulse element is not attached to the stator 8, but formed as one unit with the stator 8, which, of course, also is possible.

Fig. 5 shows a different embodiment of the barrier/pulse element 12, which has a smaller pulse surface 14 than the barrier/pulse element in Fig. 3. This barrier/pulse element 12, thus, does not produce equally strong pressure pulses. Fig. 6 shows another different embodiment of the barrier/pulse element 12, which is designed as a curved metal sheet. The barrier/pulse element, of course, can also be designed in other ways.

The portion of the barrier/pulse element 12 which faces the rotation direction of the screen means 7, should be designed so that it assists in guiding the accept out to the screen means 7. This surface should, seen radially from the inside of the stator 8 and out to the screen means, be radial as in Fig. 5 or deflected in rotation direction of the screen means 7 as in Fig. 6.

At the embodiment shown, the stator 8, screen means 7 and screen housing 1 outside the screen means 7 all have the form of a cylinder. One or several of the stator, screen

means and, respectively, screen housing outside the screen means can also, for example, have conic shape, with different or equal angle relations relative one another. By forming the screen housing outside the stator and, respectively, the stator cylindric or conical, it is possible to change the accessible space between them. By changing, for example, the screen means from cylindric to conical shape, the relation between accessible space in the screen chamber and, respectively, accept chamber can be changed. If accessible space thereby in axial direction becomes different, the space in the accept chamber should increase in the direction to the accept outlet, and the space in the screen chamber should be greatest at the inlet.

The accept outlet, reject outlet and inlet, of course, can be located in places in the screening apparatus other than indicated at the embodiment shown. The accept outlet, for example, can be located in the upper portion of the screening apparatus, and the inlet in the lower portion thereof. The reject outlet suitably is located in the lower portion of the screening apparatus, in order to utilize the gravity at the separation of heavy foreign particles.

At a variant of the stator, in addition to barrier/pulse elements it can also be provided with pulse elements of conventional type. It can, for example, be provided with 4 barrier/pulse elements and between them with usual pulse elements, where the accept can pass between the wing and stator.

A screening apparatus according to the invention, of course, can be used separately as well as in combination with other screens in a common screen housing.

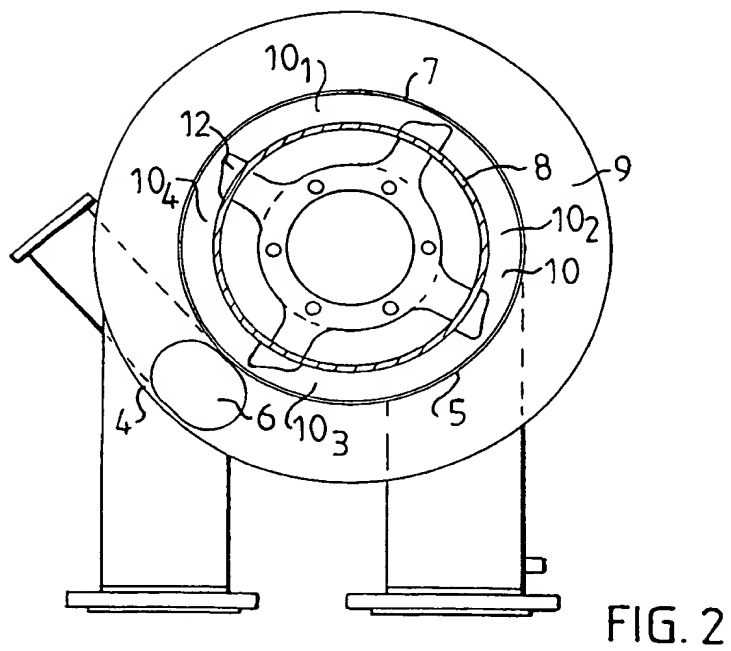
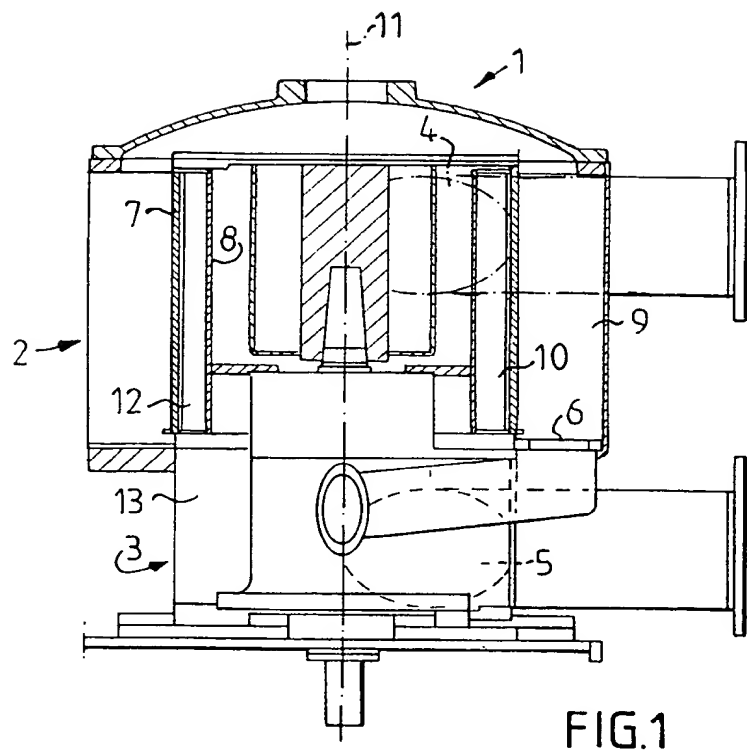
The invention, of course, is not restricted to the embodiment shown, but can be varied within the scope of the claims with reference to description and Figures.

### Claims

1. Screening apparatus for separating fiber suspensions, preferably pulp suspensions, comprising a pressurized screen housing (1), centrally located in the screen housing (1) a stator (8) enclosed by a screen means (7), which is rotary about a rotor shaft (11) and divides the interior of the screen housing (1) into a screen chamber (9) between the screen housing (1) and screen means (7) and an accept chamber (10) between the screen means (7) and stator (8), an inlet (4) for the fiber suspension to the screen chamber (9), a reject outlet (6) for reject from the screen chamber (9), and an accept outlet (5) for accept from the accept chamber (10), **characterized in** that on the stator (8) at least one barrier/pulse element (12) is located, which extends in axial direction along the entire stator (8) and substantially the entire screen means (7), and is tightly attached to the stator (8), and extends from the stator (8) out to the screen means (7), so that accept substantially is prevented from tangentially passing the barrier/pulse element (12).
2. Apparatus as defined in claim 1, **characterized in** that the barrier/pulse element (12) facing the screen means (7) has a pulse surface (14), where the distance between the pulse surface (14) and screen means (7) decreases in the rotation direction of the screen means.
3. Apparatus as defined in claim 1 or 2, **characterized in** that the barrier/pulse element (12) axially seen in the direction to the accept outlet (5) deflects in the rotation direction of the screen means (7).
4. Apparatus as defined in any of the preceding claims, **characterized in** that the portion of the barrier/pulse element (12) facing the rotation direction of the screen means (7), seen radially from the inside of the stator (8) and out to the screen means (7), is radial or deflects in the rotation direction of the screen means (7).

5. Apparatus as defined in any one of the preceding claims, **characterized in** that the stator (8), screen means (7) and screen housing (1) outside the screen means (7) all have the shape of a cylinder.
6. Apparatus as defined in any one of the claims 1-5, **characterized in** that the screen means (7) is conical with increasing diameter in the direction to the accept outlet (5).
7. Apparatus as defined in any one of the preceding claims, **characterized in** that on the stator (8) 2 to 8, but suitably 3 to 4 barrier/pulse elements (12) are located.
8. Apparatus as defined in any one of the preceding claims, **characterized in** that the minimum distance between the barrier/pulse element (12) and screen means (7) is 4 to 10 mm.
9. Stator for use in a screening apparatus defined in any one of the preceding claims, **characterized in** that the stator (8) is provided with at least one barrier/pulse element (12), which extends in axial direction along the entire stator (8) and is tightly attached to the stator (8).

1 / 2





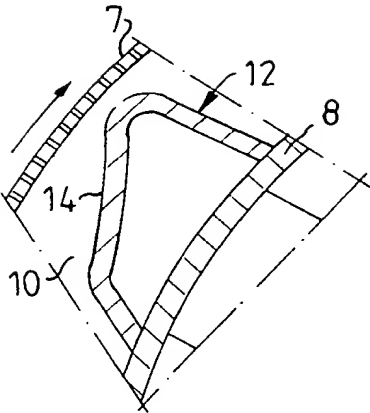


FIG. 3

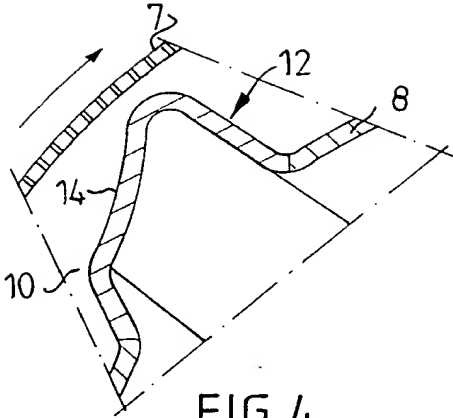


FIG. 4

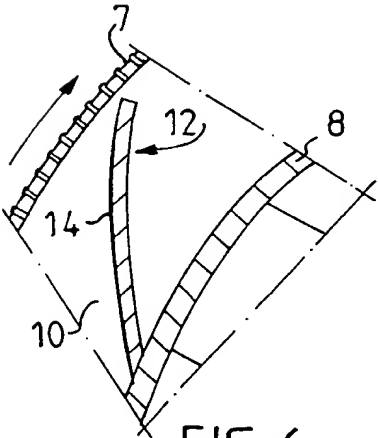


FIG. 6

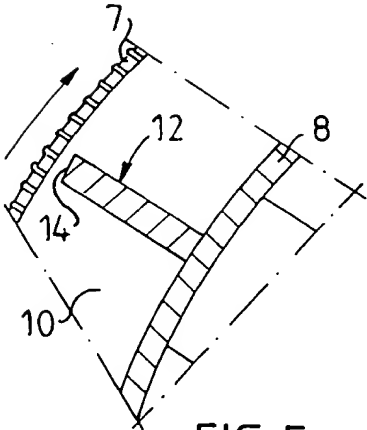


FIG. 5

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 00/00411

## A. CLASSIFICATION OF SUBJECT MATTER

IPC7: D21D 5/06

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: C21D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4529509 A (HARRY NILSSON), 16 July 1985 (16.07.85) --	1-9
A	EP 0485153 A1 (INGERSOLL-RAND COMPANY), 13 May 1992 (13.05.92) --	1-9
A	EP 0275967 A2 (A. AHLSTRÖM CORPORATION), 27 July 1988 (27.07.88) -- -----	1-9



Further documents are listed in the continuation of Box C.



See patent family annex.

\* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&amp;" document member of the same patent family

Date of the actual completion of the international search

30 June 2000

Date of mailing of the international search report

07 -07- 2000

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

02/12/99

International application No.

PCT/SE 00/00411

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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EP 0485153 A1	13/05/92	SE 0485153 T3 AT 133216 T CA 2053819 A,C DE 69116513 D,T ES 2082157 T FI 915259 A JP 4300381 A US 5143220 A	15/02/96 09/05/92 08/08/96 16/03/96 09/05/92 23/10/92 01/09/92
EP 0275967 A2	27/07/88	SE 0275967 T3 AT 69472 T CA 1329333 A DE 3866116 A FI 76139 B,C FI 870190 D JP 1972386 C JP 5033280 A JP 6096834 B JP 63249792 A	15/11/91 10/05/94 19/12/91 31/05/88 00/00/00 27/09/95 09/02/93 30/11/94 17/10/88

## Claims

Circled 97 claims 10-22

1. Screening apparatus for separating fiber suspensions, preferably pulp suspensions, comprising a pressurized screen housing (1), centrally located in the screen housing (1) a stator (8) enclosed by a screen means (7), which is rotary about a rotor shaft (11) and divides the interior of the screen housing (1) into a screen chamber (9) between the screen housing (1) and screen means (7) and an accept chamber (10) between the screen means (7) and stator (8), an inlet (4) for the fiber suspension to the screen chamber (9), a reject outlet (6) for reject from the screen chamber (9), and an accept outlet (5) for accept from the accept chamber (10), **characterized in** that on the stator (8) at least one barrier- and pulse element (12) is located, which extends in axial direction along the entire stator (8) and substantially the entire screen means (7), and is tightly attached to the stator (8), and extends from the stator (8) out to the screen means (7), so that accept substantially is prevented from tangentially passing the barrier- and pulse element (12) and the barrier- pulse element (12) is capable upon rotation of the screen means (7) to create suction pulses and pressure pulses to the fiber suspension in the screen chamber (9).
2. Apparatus as defined in claim 1, **characterized in** that the barrier- and pulse element (12) facing the screen means (7) has a pulse surface (14), where the distance between the pulse surface (14) and screen means (7) decreases in the rotation direction of the screen means.
3. Apparatus as defined in claim 1 or 2, **characterized in** that the barrier- and pulse element (12) axially seen in the direction to the accept outlet (5) deflects in the rotation direction of the screen means (7).

4. Apparatus as defined in any of the preceding claims, **characterized in** that the portion of the barrier- and pulse element (12) facing the rotation direction of the screen means (7), seen radially from the inside of the stator (8) and out to the screen means (7), is radial or deflects in the rotation direction of the screen means (7).
5. Apparatus as defined in any one of the preceding claims, **characterized in** that the stator (8), screen means (7) and screen housing (1) outside the screen means (7) all have the shape of a cylinder.
6. Apparatus as defined in any one of the claims 1-5, **characterized in** that the screen means (7) is conical with increasing diameter in the direction to the accept outlet (5).
7. Apparatus as defined in any one of the preceding claims, **characterized in** that on the stator (8) 2 to 8, but suitably 3 to 4 barrier- and pulse elements (12) are located.
8. Apparatus as defined in any one of the preceding claims, **characterized in** that the minimum distance between the barrier- and pulse element (12) and screen means (7) is 4 to 10 mm.
9. Stator for use in a screening apparatus defined in any one of the preceding claims, **characterized in** that the stator (8) is provided with at least one barrier- and pulse element (12), which extends in axial direction along the entire stator (8) and is tightly attached to the stator (8).

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close to the inlet. This is due to the fact that at screening the liquid in the pulp suspension is transported to and through the screen means at a higher speed than the fibers in the pulp suspension. Thus, a dewatering of the pulp suspension is obtained, which results in that the suspension increasingly is thickened the closer at the reject outlet it arrives. Thereby a thickened reject layer is obtained at the screen means near the reject outlet. The thickening increases still more at a relatively low flow in the reject outlet, i.e. at low reject discharge. At heavy thickening a problem arises, viz. the moment transfer between screen housing and screen means at the thickened pulp suspension. This has a braking effect on the screen means, which causes increased energy consumption for rotating the screen means and may even result in stopping the screen means. The thickening can also cause plugging and, thereby, problems with removing the reject via the reject outlet. Today, it is desired to be able to screen pulp suspensions with as high a pulp concentration as possible. The thickening, thus, becomes a great problem, because the pulp suspension already at its introduction to the screen chamber has a high concentration.

The present invention has the object to show an apparatus, which to a great extent reduces or eliminates the stated problems with thickening.

This object is achieved by a screen apparatus of the kind described in the introductory portion, which comprises at least one barrier- and pulse element (barrier/pulse element). The barrier/pulse element is located on the stator and extends in axial direction substantially along the entire stator and entire screen means and is capable upon rotation of the screen means to create in addition to suction pulses also pressure pulses to the pulp suspension in the screen chamber. The pressure pulses produce a substantially radially directed pump effect to the screen means and outward in the pulp suspension in the screen chamber, so that the reject continuously and already directly after the start of the screen passes through the reject outlet. Consequently substantially no thickened reject layer is built up, and the risk of plugging is reduced considerably. It is, thus, possible to screen at higher pulp concentrations without disturbances.